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Modern Neurocognitive Theories for Teaching EFL

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Abstract

This paper explores the application of modern neurocognitive theories in teaching English as a Foreign Language (EFL). It begins by examining traditional learning theories such as Behaviorism, Constructivism, and Sociocultural Theory, highlighting their contributions and limitations in EFL contexts. Recognizing the need for innovative approaches, the author presents the concepts and principles of neurocognitive theories, which offer evidence-based insights into the processing, storage, and retrieval of language by the brain. Moreover, the paper outlines the similarities, differences, and applications among 20 modern neurocognitive theories, emphasizing their relevance to EFL teaching. Practical applications are presented and discussed in detail, illustrating how concepts or principles such as multisensory learning, spaced repetition, and contextual engagement enhance language acquisition, retention, and fluency. In addition, the risks of oversimplification, the complexity of concepts, and the resource requirements that accompany the integration of these theories into real-world classrooms are examined. The study advocates for the integration of neurocognitive concepts to enhance EFL instruction, providing instructors with empirically supported techniques to promote learner engagement and achievement. The conclusion encourages educators and graduate students in EFL to embrace neurocognitive frameworks for designing effective lesson plans and conducting research, ensuring alignment with the latest advancements in language teaching.

Keywords: neurocognitive theories, EFL, traditional learning theories, applications of neurocognitive theories

Introduction

Back in the early 1960s, language teachers, especially in the fields of EFL and ESL followed the concepts and principles of Behaviorism proposed by B.F. Skinner was a very famous behaviorist. In principle, Behaviorism focuses mainly on learners' observable behaviors and emphasizes learning through reinforcement and repetition. In EFL contexts, this often translates to drills and memorization. However, many researchers found that they have notable disadvantages that can impact their effectiveness. Critics highlight several limitations as follows:

1. Limited Cognitive Engagement: Behaviorism does not account for internal cognitive processes such as memory, problem-solving, and critical thinking, which are essential in language learning (Study.com, 2025).

2. Short-Term Focus: Behaviorist techniques may yield quick results in behavior change, but their effects might not be long-lasting. Students might revert to previous behaviors once external incentives are removed (National University, 2025).

3. Limited Applicability: Behaviorism is less effective for teaching complex cognitive skills that require understanding beyond rote memorization (Teachers Institute, 2023).

Later during 1896-1980, Jean Piaget, a Swiss psychologist proposed the concept of Constructivism as a learning theory that emphasizes the active role of learners in building their understanding. He proposed that knowledge is not something that can emerge from a single experience but is constructed through interaction with the environment (Brau, 2018). Constructivism has been adopted for teaching in EFL, especially in teaching reading and listening comprehension. While promoting active learning, presents challenges in EFL settings as follows:

1. Time-Consuming: Learning through trial and error is a time-consuming process. In the age of a crowded curriculum, teachers often don't have the time to organize sustained problem-based learning lessons (Drew, 2023).

2. Implementation Challenges: Implementing constructivist approaches requires significant time and effort from instructors, which can be a limitation in practice. (Brau, n.d.).

3. Teacher Preparedness: Teachers may face dilemmas in constructivist classrooms, including content mastery and incompatibility between constructivism and traditional teaching approaches (Nguyen & Le, 2024).

In addition, from 1896-1934, Lev Vygotsky, a Russian psychologist, introduced the Sociocultural Theory, emphasizing the fundamental role of social interaction and cultural context in cognitive development. The key concepts of Vygotsky's theory include the Zone of Proximal Development (ZPD), which refers to the difference between what a learner can do without help and what they can achieve with guidance, and scaffolding, which involves providing support to learners as they develop new skills. The mentioned concepts have been adopted widely by educators and language teachers for EFL and ESL teaching. However, in the context of EFL education, several disadvantages of Vygotsky's theory have been identified. Here are some of them (Quizlet, 2024; Vygotsky ETEC 512, n.d.):

1. Overemphasis on Social Interaction: Vygotsky's theory places significant importance on social interaction for cognitive development. In EFL settings, this emphasis may overlook the value of individual learning strategies and the internal cognitive processes involved in language acquisition.

2. Cultural Bias: The theory is deeply rooted in the cultural context from which it originated. Applying it universally in diverse EFL classrooms can be challenging, as it may not account for cultural differences in communication styles, learning preferences, and educational values.

3. Lack of Clarity on Internalization Processes: Vygotsky's concept of internalization-the process by which social interactions become part of individual cognition-is not clearly defined. This vagueness can make it difficult for EFL educators to design effective instructional strategies that facilitate the internalization of language skills.

4. Limited Applicability to Individual Learning Differences: The theory may not adequately address individual differences in language aptitude, motivation, and learning styles among EFL students. This limitation can hinder the development of personalized teaching approaches that cater to diverse learner needs.

In summary, while Behaviorism, Constructivism, and Sociocultural Theory offer valuable insights into language learning, their limitations, for example, are neglecting cognitive processes, focusing on short-term behavior changes, being time-consuming, posing implementation challenges, overemphasis on social interaction and cultural bias, carefully considered EFL education. These limitations or disadvantages turn educators and language teachers in EFL to the applications of concepts from modern neurocognitive theories for teaching and learning. At present, there are at least 20 of them and some share similar concepts since this field of study is rather new. In this paper, their main concepts and applications for EFL will be presented so that language educators, English teachers, and graduate students in the fields of EFL/ESL and Applied Linguistics can learn some important fundamental concepts for their further studies.

However, since there are many new terms related to the neurocognitive theories and some of them carry both similar and different concepts, it would be better for us to learn their main concepts and functions to prevent confusion as follows:

Table 1

Similarities and Differences between Cognitive, Cognitive Science, Neurocognitive, Neuroscience, Neurolinguistics, and Neurosemantics Theories with Applications in EFL

No.	Name	Similarities	Differences	Citations
1	Cognitive Theory	Focuses on mental processes such as perception, memory, and problem-solving.	Emphasizes mental strategies and processes rather than physical brain structures.	Anderson, 1980
2	Cognitive Science	Interdisciplinary field combining psychology, neuroscience, linguistics, and AI to study cognition.	Broader in scope, integrating multiple disciplines beyond psychology.	Anderson, 1980
3	Neurocognitive Theory	Connects cognitive science and neuroscience, focusing on brain functions supporting cognitive processes.	Focuses specifically on the biological underpinnings of cognitive functions.	Friederici, 2011

Table 1 *(Continued)*

No.	Name	Similarities	Differences	Citations
4	Neuroscience Theory	Studies brain structures, neural networks, and their role in learning and memory.	Emphasizes brain anatomy and neural pathways over cognitive strategies.	Sousa, 2017
5	Neurolinguistics Theory	Explores brain regions involved in language processing and comprehension.	Concentrates on the relationship between brain structures and language functions.	Paradis, 2004
6	Neurosemantics Theory	Investigates how meaning is constructed and processed neurologically.	Focuses specifically on semantic processing and neural encoding of meaning.	Pulvermüller, 2002

Applications in EFL for teaching a language skill:

1. Cognitive Theory: Teachers can design tasks that enhance problem-solving, memory retention, and metacognitive skills, such as comprehension exercises and reflective journaling.
2. Cognitive Science: Teachers can adopt interdisciplinary approaches, integrating AI tools and psycholinguistic models to enhance interactive and adaptive learning experiences.
3. Neurocognitive Theory: Activities like spaced repetition, multisensory teaching methods, and mnemonic devices can strengthen neural connections and improve retention.
4. Neuroscience Theory: Emotionally engaging lessons, reducing classroom anxiety, and creating a positive learning environment can foster brain plasticity and optimize language acquisition.
5. Neurolinguistics Theory: Teachers can use language drills, pronunciation exercises, and storytelling to activate specific language-processing areas in the brain.
6. Neurosemantics Theory: Context-rich activities, semantic mapping, and multimedia tools can enhance learners' understanding of meaning and context in language.

Similarities:

1. All theories emphasize the brain and/or mental processes as central to learning and comprehension.
2. Cognitive functions such as memory, attention, and problem-solving are recognized as crucial in language acquisition.
3. The interconnection between cognitive strategies and neural mechanisms is acknowledged.

Differences:

1. Cognitive Theory focuses on mental strategies.
2. Neuroscience emphasizes brain structures.
3. Cognitive Science takes an interdisciplinary approach, combining psychology, linguistics, and AI.
4. Neurocognitive bridges biological and cognitive perspectives.
5. Neurolinguistics zeroes in on language-specific brain regions.
6. Neurosemantics focuses on the neurological processing of meaning.

In conclusion, each theory offers unique insights into language acquisition. In EFL contexts, blending these principles allows educators to design evidence-based, brain-friendly, and cognitively engaging lesson plans, maximizing learning outcomes. However, for the rest of the paper, to make the readers catch up with a new trend in language teaching and learning in EFL, only the concepts, principles, and applications of some modern neurocognitive theories will be presented.

Typical Characteristics of Neurocognitive Theories

The typical characteristics of the neurocognitive theories are as follows:

1. Integration of Neural and Cognitive Mechanisms: These theories explain cognitive processes (e.g., memory, learning, perception) in terms of brain structures and neural activity (Craik & Lockhart, 1972; Baddeley & Hitch, 1974).
2. Empirical Evidence: They rely on data from neuroimaging (e.g., fMRI, EEG) and lesion studies to support their claims (Friston, 2005; Squire, 1987).
3. Focus on Brain Plasticity: Many emphasize the brain's adaptability in response to experience and learning (Merzenich, 1998).
4. Computational Models: Some theories, like ACT-R (Anderson, 1996) and Connectionism (McClelland & Rumelhart, 1986), use computational frameworks to simulate cognitive processes.
5. Hierarchical Processing: They often describe cognitive functions as arising from hierarchical brain networks (Friston, 2005).
6. Modularity vs. Distributed Processing: Some theories propose specialized brain modules e.g., Dual-Route Model (Coltheart, 2001), while others emphasize distributed processing networks e.g., Connectionism (McClelland & Rumelhart, 1986).
7. Emphasis on Plasticity and Experience: Learning and adaptation are central themes (Hebb, 1949; Karmiloff-Smith, 1992).

In addition, neurocognitive theories provide valuable insights into the intricate relationship between neural mechanisms and cognitive functions, offering practical applications for teaching language skills in EFL settings. They focus on understanding how the brain processes language and learning, providing valuable insights into the mechanisms underlying language acquisition In addition, many advantages of neurocognitive theories in teaching EFL are as follows:

1. Facilitate Language Retention through Memory Optimization

They emphasize the importance of working memory and long-term memory in language learning. Techniques informed by these theories can enhance retention. For instance, repetition, retrieval practice, and spaced learning capitalize on the brain's natural mechanisms for consolidating information (Baddeley & Hitch, 2003). For

example, in EFL, integrating activities that repeatedly expose learners to vocabulary and grammar over time, boosts their ability to recall and use these elements in real-world contexts.

2. Promote Multisensory Learning

They highlight the value of engaging multiple sensory modalities to strengthen neural connections. Activities that combine visual, auditory, and kinesthetic elements activate different brain regions, reinforcing learning. For example, in EFL teaching vocabulary through images, sounds, and physical actions creates stronger neural associations, making it easier for learners to remember and use the language.

3. Enhance Motivation and Reduce Cognitive Overload

They emphasize minimizing cognitive overload to keep learners engaged and motivated. Techniques such as chunking information into manageable units and scaffolding new material with prior knowledge align with how the brain processes information (Sweller & Kalyuga, 2011). EFL teachers can introduce new grammar rules or vocabulary in small, digestible segments, making the learning process less intimidating and more achievable for students.

4. Support Individualized Learning

They acknowledge the diversity in learners' brain structures and cognitive processes, promoting a tailored approach to teaching. For example, some students may excel in pattern recognition and learn grammar rules intuitively, while others benefit from explicit instruction and practice. Leveraging neurocognitive principles, EFL educators can identify these differences and adapt their teaching strategies to suit individual needs.

5. Encourage the Use of Contextual and Authentic Language

According to neurocognitive research, the brain is more likely to retain language learned in meaningful, real-world contexts. Authentic materials and immersive activities, such as storytelling or role-playing, stimulate the brain's episodic memory, which links language to experiences. In EFL, contextualizing lessons within relevant scenarios helps students understand not only the "what" but also the "why" of language use, fostering deeper comprehension and fluency.

6. Improve Focus and Attention through Brain-Based Techniques

They offer strategies for enhancing attention, a critical factor in effective language learning. Techniques such as incorporating novelty, using engaging stimuli, and providing frequent breaks align with the brain's natural attentional cycles. In an EFL classroom, activities like interactive games or multimedia resources can capture students' interest and maintain their focus, ensuring better absorption of material.

7. Foster Emotional Engagement for Deeper Learning

Emotions play a significant role in memory and learning, as emotional experiences activate the amygdala, enhancing information encoding. Neurocognitive principles suggest that creating a positive, low-stress learning environment can boost students' confidence and willingness to participate. EFL teachers can incorporate humor, collaborative projects, and encouragement to foster an emotionally supportive atmosphere.

Therefore, applying neurocognitive concepts or principles to EFL teaching ensures a brain-compatible approach, enhancing learning outcomes through improved retention, engagement, and adaptability. Below is an overview of 20 prominent neurocognitive theories, their founders, years of proposal, main concepts, and examples

of their application in EFL teaching. They are presented chronologically starting with the oldest one:

1. Neural Reuse Theory

This theory was proposed by Anderson (2010*)* with its main concepts and principles as follows:

1) Neural circuits originally evolved for one function are often repurposed for new cognitive tasks.

2) Learning involves repurposing and reconfiguring existing neural networks.

3) Flexibility and adaptability are key aspects of brain function.

The concepts/principles can be applied in EFL teaching, e.g. writing skills:

Step 1: Repurpose Familiar Skills: Connect writing tasks with previously learned skills (e.g., storytelling or summarizing experiences).

Step 2: Scaffold Writing Tasks: Break tasks into smaller steps (e.g., brainstorming, drafting, revising).

Step 3: Use Multisensory Inputs: Combine writing with visual aids, gestures, and voice recordings.

Step 4: Interactive Writing Exercises: Include collaborative writing tasks where students repurpose spoken ideas into written form.

Step 5: Reflect and Adjust: Allow students to reflect on their writing strategies and adapt them for future tasks.

2. Hebbian Theory

This theory was proposed by D. Hebb in 1949 (Hebb, 1949) with its main concepts and principles as follows:

1) "Neurons that fire together, wire together."

2) Learning is based on strengthening connections between neurons when they are repeatedly activated simultaneously.

3) Synaptic plasticity is the foundation of learning and memory.

The concepts/principles can be applied in EFL teaching, e.g. vocabulary skills:

Step 1: Pair Words with Visual Stimuli: Use flashcards with images and words simultaneously.

Step 2: Repetition in Context: Repeat new words in sentences and stories.

Step 3: Group Words by Themes: Teach words in meaningful groups (e.g., words related to weather).

Step 4: Interactive Activities: Use group discussions or role-plays for active repetition.

Step 5: Regular Retrieval Practice: Include spaced repetition exercises.

3. Dual-Coding Theory

This theory was proposed by Paivio (1971) with its main concepts and principles as follows:

1) The brain processes information through two channels:

a. Verbal (Linguistic Channel): Processes spoken and written words.

b. Non-verbal (Imagery Channel): Processes images and other sensory information.

2) Learning is more effective when information is presented using both verbal and visual formats because they create dual mental representations, reinforcing memory and understanding.

The concepts/principles can be applied in EFL teaching, e.g. vocabulary skills:

Step 1: Introduce Words with Images: Present new vocabulary words alongside relevant images.

Step 2: Use Mnemonics: Associate words with memorable visuals.

Step 3: Encourage Visualization: Ask students to create mental images for words or phrases.

Step 4: Combine Verbal and Visual Practice: Pair spoken words with written text and pictures.

Step 5: Interactive Activities: Use flashcards, videos, and multimedia tools.

4. Levels of Processing Theory

This theory was proposed by Craik and Lockhart (1972) with its main concepts and principles as follows:

1) Memory retention depends on the depth of processing:

a. Shallow Processing: Focus on surface details (e.g., spelling, sound).

b. Deep Processing: Focus on meaning and connections.

2) Deeper levels of processing result in stronger memory traces.

The concepts/principles can be applied in EFL teaching, e.g. vocabulary skills:

Step 1: Shallow Processing: Start with repetition exercises (e.g., saying words aloud).

Step 2: Semantic Processing: Ask students to define words in their own words.

Step 3: Contextual Processing: Place words in meaningful sentences or stories.

Step 4: Personal Connection: Ask students to relate words to personal experiences.

Step 5: Collaborative Tasks: Use group activities to reinforce word usage in context.

5. Working Memory Model

This theory was proposed by Baddeley and Hitch (1974) with its main concepts and principles as follows:

Working memory has four components:

a. Phonological Loop: Processes auditory and verbal information.

b. Visuospatial Sketchpad: Handles visual and spatial data.

c. Central Executive: Controls attention and integrates information.

d. Episodic Buffer: Links working memory with long-term memory.

The concepts/principles can be applied in EFL teaching, e.g. listening comprehension skills:

Step 1: Short Listening Tasks: Use brief audio clips to prevent cognitive overload.

Step 2: Note-taking Exercises: Have students jot down key points while listening.

Step 3: Multisensory Support: Use visuals alongside audio inputs.

Step 4: Chunking Information: Present audio content in small, manageable chunks.

Step 5: Immediate Practice: Encourage students to repeat or summarize audio material immediately.

6. Embodied Cognition Theory

This theory was proposed by Lakoff and Johnson (1980) with its main concepts and principles as follows:

1) Cognitive processes are deeply rooted in the body's sensorimotor experiences.

2) Abstract concepts are understood through bodily metaphors and experiences.

3) Learning is enhanced when physical actions accompany cognitive tasks.

The concepts/principles can be applied in EFL teaching, e.g. listening and speaking skills:

Step 1: Gesture-Based Speaking Practice: Encourage hand gestures when explaining ideas.

Step 2: Physical Role-Play: Have students physically act out dialogues.

Step 3: Metaphor Exploration: Discuss metaphors (e.g., "time flies") and act them out.

Step 4: Interactive Games: Use movement-based games for speaking prompts.

Step 5: Reflect on Physical Cues: Discuss how gestures and movement aided communication.

7. Connectionism

This theory was proposed by McClelland and Rumelhart (1986) with its main concepts and principles as follows:

1) Cognitive processes are based on parallel distributed processing (PDP).

2) Knowledge is represented by connections between nodes in neural networks.

3) Learning occurs by adjusting the strength of these connections.

The concepts/principles can be applied in EFL teaching, e.g. grammar skills:

Step 1: Pattern Recognition: Use repeated exposure to grammatical structures in context.

Step 2: Interactive Exercises: Use cloze tests and sentence completion activities.

Step 3: Error Correction: Guide students to recognize and correct patterns of errors.

Step 4: Consistent Practice: Provide frequent practice with similar structures.

Step 5: Feedback Integration: Reinforce correct grammar usage through targeted feedback.

8. Cognitive Neuroscience of Memory

This theory was proposed by Squire (1987) with its main concepts and principles as follows:

1) Memory is divided into declarative (explicit) and non-declarative (implicit) systems.

2) Declarative memory involves facts and events (e.g., vocabulary, grammar rules).

3) Non-declarative memory involves skills and habits (e.g., speaking fluently).

4) Brain structures: Hippocampus, amygdala, prefrontal cortex, and cerebellum.

The concepts/principles can be applied in EFL teaching, e.g. listening comprehension skills:

Step 1: Declarative Memory Focus: Teach students to recognize common phrases and grammar in listening exercises.

Step 2: Implicit Practice: Use repeated listening drills for automatic understanding.

Step 3: Interactive Activities: Use group listening tasks with discussions.

Step 4: Audio Repetition: Play recordings multiple times to reinforce memory.

Step 5: Reflection and Review: Discuss the listening task to solidify understanding.

9. Global Workspace Theory (GWT)

Main Concepts/Principles:

This theory was proposed by Baars (1988*)* with its main concepts and principles as follows:

1) Consciousness emerges from the integration of information across distributed brain networks.

2) The global workspace acts like a "theater of the mind" where different cognitive processes share and broadcast information.

3) Focused attention is crucial for learning complex tasks.

The concepts/principles can be applied in EFL teaching, e.g. listening comprehension skills:

Step 1: Attention Warm-Up: Start with focused listening exercises (e.g., listen to a short story and identify key points).

Step 2: Highlight Key Information: Use auditory cues (e.g., pauses, intonation) to emphasize critical details.

Step 3: Integrate Multiple Inputs: Combine listening with visual aids (e.g., subtitles or images).

Step 4: Reflective Listening: Have students share what they understood and compare it with peers.

Step 5: Gradual Complexity: Increase listening task difficulty progressively to maintain attention without cognitive overload.

10. Neuroconstructivism Theory

This theory was proposed by Karmiloff-Smith (1992) with its main concepts and principles as follows:

1) Cognitive development emerges from the interaction between genes, the brain, and the environment.

2) Knowledge is progressively constructed through experience and repeated exposure.

3) Brain development is context-dependent, and learning occurs through neural specialization and plasticity.

The concepts/principles can be applied in EFL teaching, e.g. speaking skills:

Step 1: Start with Basic Conversations: Use simple, repeated phrases (e.g., greetings, introductions).

Step 2: Scaffold Speaking Tasks: Gradually increase complexity from simple dialogues to more extended discussions.

Step 3: Interactive Group Activities: Pair students for role-plays and conversation tasks.

Step 4: Contextual Practice: Link speaking tasks to meaningful contexts (e.g., ordering food, asking for directions).

Step 5: Reflect and Adapt: Provide reflective exercises after speaking tasks to strengthen neural pathways.

11. Somatic Marker Hypothesis

This theory was proposed by Damasio (1994) with its main concepts and principles as follows:

1) Emotional and bodily states (somatic markers) influence decision-making and reasoning processes.

2) The ventromedial prefrontal cortex (vmPFC) integrates emotional signals with cognitive processing.

3) Emotions act as shortcuts for decision-making, aiding cognitive functions like attention, memory, and problem-solving.

The concepts/principles can be applied in EFL teaching, e.g. speaking skills:

Step 1: Emotionally Engaging Scenarios: Use real-life or emotionally charged scenarios for speaking practice (e.g., describing a favorite childhood memory).

Step 2: Bodily Reactions Awareness: Encourage students to observe physical responses (e.g., nervousness, excitement) while speaking.

Step 3: Reflective Discussion: After speaking tasks, guide students to reflect on their emotional experiences during the task.

Step 4: Feedback Integration: Provide positive feedback linked to emotional and physical responses (e.g., "You sounded confident when you shared your story").

Step 5: Role-play Activities: Create role-plays based on emotionally engaging situations to anchor learning with emotional markers.

12. Theory of Mind (Neurocognitive Aspect)

This theory was proposed by (Baron-Cohen) 1995) with its main concepts and principles as follows:

1) Theory of Mind (ToM) refers to the ability to understand others' mental states (e.g., beliefs, emotions, intentions).

2) It relies on specific brain regions: the medial prefrontal cortex (mPFC), temporoparietal junction (TPJ), and amygdala.

3) ToM is crucial for effective communication and social interaction.

The concepts/principles can be applied in EFL teaching, e.g. speaking skills:

Step 1: Role-Play Scenarios: Create conversations requiring students to infer others' intentions (e.g., asking for help, giving directions).

Step 2: Perspective-Taking Exercises: Ask students to retell a story from another character's viewpoint.

Step 3: Emotional Cues Practice: Use videos or images showing facial expressions and discuss the emotions displayed.

Step 4: Storytelling Activities: Have students create stories where characters have hidden motives.

Step 5: Reflective Discussion: After role-plays or tasks, discuss how understanding others' perspectives improved communication.

13. ACT-R Theory (Adaptive Control of Thought-Rational)

This theory was proposed by Anderson (1996*)* with its main concepts and principles as follows:

1) ACT-R explains how the brain organizes and retrieves knowledge to perform tasks.

2) It combines declarative memory (facts) and procedural memory (skills).

3) The brain uses production rules (if-then rules) for decision-making and learning.

The concepts/principles can be applied in EFL teaching, e.g. grammar structures, and sentence patterns:

Step 1: Explicit Instruction: Teach specific writing rules (e.g., grammar structures, sentence patterns).

Step 2: Guided Practice: Use fill-in-the-blank exercises to apply the rules.

Step 3: Procedural Practice: Provide writing prompts requiring repeated application of rules.

Step 4: Error Correction with Rules: Guide students to identify errors using specific production rules.

Step 5: Reflective Writing Practice: Ask students to evaluate their writing based on learned rules.

14. Multiple-Trace Theory (MTT)

This theory was proposed by Nadel and Moscovitch (1997) with its main concepts and principles as follows:

1) Each time a memory is retrieved, a new trace is created in the hippocampus.

2) Episodic memories remain dependent on the hippocampus indefinitely.

3) Repeated retrieval strengthens and stabilizes memory traces.

The concepts/principles can be applied in EFL teaching, e.g. vocabulary skills:

Step 1: Frequent Retrieval Practice: Encourage repeated exposure and retrieval of vocabulary in different contexts.

Step 2: Use Mnemonics: Link vocabulary to visual or emotional cues to create stronger traces.

Step 3: Spaced Repetition: Revisit words periodically to reinforce traces.

Step 4: Contextual Usage: Incorporate vocabulary into sentences, stories, and conversations.

Step 5: Reflect on Learning: Have students assess how they remembered specific words and their strategies.

15. Theory of Neural Plasticity

This theory was proposed by Merzenich (1998) with its main concepts and principles as follows:

1) The brain is capable of adapting and reorganizing itself through experience and learning.

2) Neural pathways strengthen with repeated use and weaken without it.

3) Critical periods exist for certain types of learning.

The concepts/principles can be applied in EFL teaching, e.g. pronunciation skills:

Step 1: Repetitive Practice: Use pronunciation drills for challenging sounds.

Step 2: Auditory Discrimination: Train students to recognize subtle differences in sounds.

Step 3: Immediate Feedback: Provide real-time feedback on pronunciation.

Step 4: Role-Playing: Use real-life scenarios to practice pronunciation.

Step 5: Consistent Reinforcement: Regularly revisit challenging sounds.

16. Perceptual Symbol Systems Theory

This theory was proposed by Barsalou (1999) with its main concepts and principles as follows:

1) Knowledge is represented in the brain as perceptual symbols derived from sensory experiences.

2) Understanding words or concepts involves activating sensory-motor representations.

3) Brain regions associated with sensory and motor functions are involved in conceptual processing.

The concepts/principles can be applied in EFL teaching, e.g. Vocabulary skills:

Step 1: Multisensory Vocabulary Practice: Teach words using images, sounds, and physical gestures.

Step 2: Action-Based Learning: Pair vocabulary words with actions (e.g., mime the word "jump").

Step 3: Real-Life Contexts: Use real objects (e.g., show an apple when teaching the word "apple").

Step 4: Story Creation with Symbols: Have students create stories using sensory-rich descriptions.

Step 5: Reflect and Review: Encourage students to recall vocabulary using associated sensory cues.

17. Declarative-Procedural Model

This theory was proposed by Ullman (2001) with its main concepts and principles as follows:

1) Language learning relies on two brain memory systems:

a. Declarative Memory: Stores vocabulary and facts.

b. Procedural Memory: Manages grammar and automatic language skills.

2) Different brain regions are involved (e.g., hippocampus for declarative, basal ganglia for procedural).

The concepts/principles can be applied in EFL teaching, e.g. grammar skills:

Step 1: Teach Grammar Rules Explicitly: Focus on declarative memory through rule explanation.

Step 2: Practice Through Drills: Use repeated grammar exercises for procedural memory.

Step 3: Interactive Activities: Apply grammar rules in conversations.

Step 4: Story Creation: Let students write or tell stories using grammar rules.

Step 5: Reflect on Mistakes: Guide students to identify and correct grammar errors.

18. Dual-Route Model of Reading Theory

This theory was proposed by Coltheart (2001) with its main concepts and principles as follows:

1) Reading comprehension occurs through two routes:

a. Lexical Route: Recognizing whole words as visual patterns.

b. Non-Lexical Route: Decoding words using phonics rules.

2) Both routes are necessary for efficient reading comprehension.

The concepts/principles can be applied in EFL teaching, e.g. reading comprehension skills:

Step 1: Phonics Training: Teach students sound-letter correspondence.

Step 2: Sight Words Practice: Introduce high-frequency words for memorization.

Step 3: Blended Reading Exercises: Combine phonics and whole-word recognition tasks.

Step 4: Guided Reading Sessions: Provide texts with phonically decodable and irregular words.

Step 5: Comprehension Activities: Discuss content after reading exercises.

19. Predictive Coding Theory

This theory was proposed by Friston (2005) with its main concepts and principles as follows:

1) The brain creates internal models (predictions) about incoming sensory information.

2) Discrepancies between predictions and actual input (prediction errors) drive learning and adaptation.

3) The brain continuously adjusts its models to reduce prediction errors.

The concepts/principles can be applied in EFL teaching, e.g. listening comprehension skills:

Step 1: Prediction Exercises: Before listening, ask students to predict content based on the title or introduction.

Step 2: Active Listening Tasks: Play short audio clips and pause to discuss predictions.

Step 3: Focus on Gaps: Highlight and discuss moments where predictions were incorrect.

Step 4: Repeat Listening with Reflection: Replay audio to reinforce correct predictions.

Step 5: Summarization Task: Have students summarize the audio, focusing on corrected predictions.

20. Biopsychosocial Model of Stress and Cognition

This theory was proposed by Lupien et al. (2009) with its main concepts and principles as follows:

1) Stress hormones (e.g., cortisol) significantly impact memory, attention, and executive functions.

2) Chronic stress can impair cognitive functions, while moderate stress can enhance performance.

3) Emotional regulation and stress management are critical for effective learning.

The concepts/principles can be applied in EFL teaching, e.g. reading comprehension skills:

Step 1: Reduce Stressful Conditions: Create a relaxed and supportive reading environment.

Step 2: Scaffold Reading Tasks: Provide structured reading exercises with clear goals.

Step 3: Mindfulness Breaks: Include short mindfulness or breathing exercises before reading tasks.

Step 4: Positive Reinforcement: Offer encouragement to reduce anxiety related to comprehension struggles.

Step 5: Reflective Practice: Have students discuss their emotional state before and after reading tasks.

Although the neurocognitive theories are beneficial for teaching EFL, as mentioned above, they have some disadvantages in teaching EFL. Below are some of them, supported by scholarly evidence and examples.

1. Complexity of Theories and Lack of Practicality

Neurocognitive theories are often complex and require specialized knowledge to understand and apply effectively. Many educators lack the training in neuroscience needed to interpret and implement these theories in their teaching practices. For instance, while concepts like working memory and cognitive load are well-documented, translating them into classroom activities requires careful planning and may not be intuitive for teachers without formal neuroscience education.

2. Limited Empirical Evidence in Classroom Contexts

While neurocognitive theories are supported by laboratory research, their application in real-world EFL classrooms is still underdeveloped. Many studies are conducted in controlled environments, which do not account for the variability of classroom settings, such as cultural differences, resource availability, or student diversity. This gap between theories and practice makes it challenging for educators to rely solely on neurocognitive principles.

3. Overemphasis on Cognitive Processes Over Sociocultural Factors

Neurocognitive theories primarily focus on individual brain functions, often overlooking the sociocultural context of language learning (Vygotsky, 1978). EFL learners are influenced not only by cognitive processes but also by social interactions, cultural norms, and motivations. Solely applying neurocognitive principles may neglect these important external factors, leading to an incomplete approach to language teaching.

4. Resource-Intensive Implementation

Applying neurocognitive principles in the classroom often requires additional resources, such as advanced teaching materials, technology, or teacher training programs. For example, using multisensory techniques or immersive tools like virtual reality can be effective but may be prohibitively expensive for schools with limited budgets. This creates disparities in the quality of EFL instruction across different institutions.

5. Risk of Oversimplification or Misapplication

There is a risk that educators may oversimplify or misapply neurocognitive concepts due to a lack of understanding. For example, popular ideas like “learning styles” and "left-brain/right-brain dominance" have been debunked as myths but continue to influence classroom practices inaccurately. Misusing neurocognitive theories can lead to ineffective or even counterproductive teaching methods.

6. Challenges in Addressing Individual Differences

While neurocognitive theories emphasize the importance of tailoring instruction to individual learners, identifying and addressing these differences in a large, diverse classroom can be difficult. Teachers may find it impractical to design personalized activities for each student, particularly in under-resourced settings where class sizes are large, and individual attention is limited.

7. Time Constraints in Curriculum Delivery

Implementing neurocognitive strategies, such as spaced repetition and multisensory activities, often requires more time than traditional teaching methods. EFL teachers working within strict curriculum guidelines may struggle to balance these strategies with the need to cover all required material within a limited timeframe (Sweller & Kalyuga, 2011). This can lead to a conflict between applying brain-based techniques and meeting institutional demands.

8. Potential for Overgeneralization

Neurocognitive theories are based on generalized findings about the human brain, which may not apply equally to all learners. Factors like age, first language, prior education, and learning disabilities can significantly affect how students respond to neurocognitive approaches. For instance, adult learners may process language differently than children due to differences in neural plasticity. Overgeneralizing these theories can limit their effectiveness for diverse learner populations.

Conclusion

Therefore, based on the application examples of modern neurocognitive theories in the aforementioned EFL, they can explicitly offer significant benefits for language educators, teachers, and graduate students in the field of Applied Linguistics and EFL, by providing evidence-based strategies for enhancing language acquisition and instruction. Theories such as Dual-Coding Theory (Paivio, 1971), Working Memory Theory (Baddeley & Hitch, 1974), and insights from neuroplasticity research (Draganski et al., 2004) highlight the intricate processes underlying how the brain processes, stores, and retrieves language information. For example, the Dual-Coding Theory emphasizes the importance of using both verbal and visual channels to reinforce learning, making it particularly effective for vocabulary instruction, where pairing words with images can create stronger mental associations (Paivio, 1971). Likewise, Working Memory Theory underscores the brain's limited capacity to hold and manipulate information in short-term memory, which emphasizes the importance of chunking information, providing repetition, and allowing sufficient time for processing in language lessons (Baddeley & Hitch, 1974). Furthermore, research on neuroplasticity demonstrates the brain's remarkable ability to adapt and reorganize itself in response to language exposure and practice, highlighting the importance of regular, meaningful engagement with language tasks to facilitate long-term retention and skill development (Draganski et al., 2004). For graduate students specializing in EFL, understanding these neurocognitive principles equips them with the tools to design scientifically informed lesson plans, create engaging materials, and conduct research grounded in brain-based evidence. By aligning teaching methodologies with these neurocognitive insights, educators can foster learning environments that enhance language comprehension, retention, and fluency, ultimately empowering students to achieve greater proficiency and confidence in their language skills (Paivio, 1971; Baddeley & Hitch, 1974; Draganski et al., 2004).

However, while neurocognitive theories offer valuable insights into EFL instruction, their practical application presents challenges such as complexity, resource requirements, and potential oversights of sociocultural influences. *To catch up with the modern trend in English teaching at all levels, it is strongly recommended for educators, language teachers, and graduate students in any fields related to EFL to further explore and apply the concepts or principles of the modern neurocognitive theories mentioned in this paper for their teaching including conducting some research studies to investigate their effectiveness. If not, their teaching techniques can be considered old-fashioned, outdated, and unprofessional!*

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